Weston & Sampson

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January 9, 2017

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Re: **ChemFab (SMS# 2016-4630), Data Quality Evaluation for PFC Analysis**
January 2017 update

This letter presents an updated evaluation of data quality for the ongoing investigation into the nature and extent of perfluorinated compound (PFC) groundwater contamination in Bennington and North Bennington, Vermont. This evaluation process ensures that the type, quantity, and quality of the data used in decision-making are defensible.

Data quality was evaluated using the criteria established in the Sampling Plan and Weston & Sampson's Vermont Generic Quality Assurance Project Plan (QAPP), approved April 8, 2014 by the United States Environmental Protection Agency (EPA) Region 1. Criteria have been established for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARRCS). Each criterion is discussed in detail below.

Precision

Precision is a measure of mutual agreement among individual sample results at the same location. It is generally expressed as the reproducibility of the analytical result from the initial sample and a field duplicate sample. The target collection rate for field duplicate samples is between 5-10% of the total number of samples. Reproducibility between the sample and the field duplicate is expressed by the relative percent difference (RPD), calculated as follows:

$$\frac{|\text{(sample concentration)} - \text{(duplicate concentration)}|}{\text{(simple average of sample and duplicate concentration)}} \times 100 = \text{RPD (\%)}$$

To date, 849 total sample results have been received and tabulated. Field duplicates have been collected at 78 of these sample locations (9% of total samples). The RPD value for each sample/duplicate pair was calculated and is presented in Table 1. The acceptable RPD value for water (<30%) was achieved at 97% of sample/duplicate pairs; the remaining two samples have RPDs between 33% and 36% and were for sample results near the detection limit (3.3 ppt) for the specific compound (PFHpA). Perfluorooctanesulfonic acid (PFOS) was detected in only one of the duplicate samples (with an RPD value of 6%) and is not included in Table 1.

Please note that the previous data quality report (July 2016) indicated that PFOA concentration RPDs for four duplicate samples were above the acceptable RPD value (between 32% and 37%). This was due to an error in the spreadsheet formula and the data are shown corrected in Table 1.

Accuracy

Accuracy is the degree of measurement with an accepted reference or true value. Accuracy can be evaluated with laboratory control sample (LCS) results, surrogate results, matrix spike/matrix spike duplicate (MS/MSD) results, calibration QC results, and field and laboratory blank results.

The degree of accuracy demonstrated for laboratory control and matrix spike samples is expressed as a percent recovery. The percent recovery indicates the amount of known, spiked concentration of an analyte that has been detected. The percent recovery (%R) is calculated as follows:

$$\%R = (SSR - SR)/SA \times 100$$

Where:
SSR = the spiked sample result.
SR = the unspiked sample result.
SA = the value of the spike added.

Laboratory data quality objectives for accuracy as measured by %R were provided in the laboratory SOPs. For surrogate recoveries from spiked samples, the identified data quality objective was between 70%-130%. Surrogate %R objectives were achieved for 848 of the 849 samples (99.9%).

Trip blanks are collected at all sample locations in accordance with Weston & Sampson and laboratory standard operating procedures (SOPs). Initially, the trip blanks were analyzed at any sample location where PFC concentrations were identified above laboratory detection limits. Currently, field blanks are only analyzed if the reported PFC concentrations are in conflict with data from surrounding locations, or significantly different that previously collected data at the same location. None of the >300 trip blanks analyzed to date have reported PFC concentrations above the laboratory detection limit.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variation, or environmental condition. Weston & Sampson has reviewed the data qualitatively for representativeness through internal field sampling audits and a review of field duplicates results. At the time of the last data quality report, PFOS was identified in 2 of the 483 samples analyzed at that time, which was unexpected. Weston & Sampson requested that the laboratory recheck these samples; the results were determined to be accurate. Since that time, the detection limit for PFOS has been reduced (from 13 ppt, to 3.8 ppt, and now to 2.2 ppt), and PFOS has been detected in an additional 12 samples. Based on the earlier detections of PFOS and the lowered detection limits, these new PFOS detections were not identified as anomalous. No other unexpected, unusual, or anomalous results have been identified to date.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system relative to the amount expected under normal conditions. Completeness is expressed as a percentage and is determined as follows:

$$\text{Completeness (A\%)} = \frac{\text{\# of valid values reported}}{\text{\# of samples collected}} \times 100$$

The project completeness goal is 85-90% percent of the samples being successfully analyzed. To date, all samples collected have been successfully analyzed, for a completeness of 100%.

Comparability

Comparability refers to the ability to generate data for each parameter that is both comparable between sampling locations and over time. Comparability is a qualitative parameter that expresses the confidence with which data sets can be compared to one another. Comparable data allows for the ability to combine analytical results (e.g., current data with historical data) and relies upon precision and accuracy within the individual data sets. Based on the current degree of precision and accuracy reported for the current dataset, it is anticipated that this dataset will be comparable to future datasets from the area of investigation.

Data Sensitivity
Sensitivity is a measure of whether the laboratory method was sufficient to report detected contaminants at concentrations at or below the applicable regulatory criteria. In December 2016, the State of Vermont Agency of Natural Resources adopted a Primary Drinking Water Standard of 20 ppt, applicable to the sum of two PFCs, perfluorooctanic acid (PFOA) and PFOS. The laboratory reporting limits are below the required standards and are adequately sensitive for the ongoing investigation.

Conclusions
The results of the data quality evaluation indicate that the data obtained during this investigation are adequate for characterizing the nature and extent of PFC groundwater contamination. Weston & Sampson considers the data to be of sufficient quality to support future decision making and to be comparable to datasets of similar quality.

Please contact me directly by phone at (802) 244-5051 x6007 or by e-mail at larosas@wseinc.com if you have any questions or require further information.

Sincerely,
WESTON & SAMPSON

StevenLaRosa
Senior Project Manager

Enclosures

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TABLE 1
RELATIVE PERCENT DIFFERENCE (RPD)
CHEMFAB (SMS# 2016-4630)
BENNINGTON/NORTH BENNINGTON, VERMONT

Sample ID	Date	Sample PFOA	Duplicate PFOA	Sample PFHpA	Duplicate PFHpA	PFOA RPD	PFHpA RPD
22 Asa Way	2/16/2016	2,330	2,390	81.4	85.6	3%	5%
10301161106	3/1/2016	293	349	14.7	18.1	17%	21%
10301161555	3/1/2016	245	228	12.3	11.7	7%	5%
10301161950	3/1/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
2030120161754	3/1/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
10302161259	3/2/2016	60.3	55.6	ND/<3.3	ND/<3.3	8%	0%
10302161933	3/2/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
2030220161031	3/2/2016	82.2	85.9	3.65	3.74	4%	2%
10303161638	3/3/2016	76.2	77.9	8.94	9.49	2%	6%
10303161948	3/3/2016	71.3	75.7	3.93	3.71	6%	6%
2030320161340	3/3/2016	183	177	8.62	8.33	3%	3%
2030320161721	3/3/2016	10.1	8.79	ND/<3.3	ND/<3.3	14%	0%
2030420161125	3/4/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
10308161520	3/8/2016	100	106	ND/<3.3	ND/<3.3	6%	0%
2030820161308	3/8/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
2030820161649	3/8/2016	241	247	9.5	9.98	2%	5%
2030920161143	3/9/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
2030920161506	3/9/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
30321161551	3/21/2016	120	146	6.55	7.8	20%	17%
30321161841	3/21/2016	59.4	70.9	4.73	ND/<3.3	18%	**36%**
30321162040	3/21/2016	79	70.9	ND/<3.3	ND/<3.3	11%	0%
30322161602	3/22/2016	96.6	93.8	4.35	4.42	3%	2%
30323161044	3/23/2016	11.3	8.4	ND/<3.3	ND/<3.3	29%	0%
30323161407	3/23/2016	8.7	8.5	ND/<3.3	ND/<3.3	3%	0%
10331161235	3/31/2016	264	248	9.04	8.72	6%	4%
10412161732	4/12/2016	50.9	46.1	5.06	ND/<3.3	10%	42%
70412161848	4/12/2016	105	109	5.25	5.48	4%	4%
10413161432	4/13/2016	63.4	67.8	ND/<3.3	ND/<3.3	7%	0%
10413161953	4/13/2016	12.2	13.8	ND/<3.3	ND/<3.3	12%	0%
70413161104	4/13/2016	132	127	7.21	7.19	4%	0%
70413161746	4/13/2016	25.1	19.5	ND/<3.3	ND/<3.3	25%	0%
10419161314	4/19/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
10419161946	4/19/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
20420161243	4/20/2016	17.5	17.7	ND/<3.3	ND/<3.3	1%	0%
70502161644	5/2/2016	115	108	5.68	5.26	6%	8%
70503161407	5/3/2016	14.4	13.2	ND/<3.3	ND/<3.3	9%	0%
70503161754	5/3/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
70504161431	5/4/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
70510161545	5/10/2016	18.7	21.3	ND/<3.3	ND/<3.3	13%	0%
70510161958	5/10/2016	92.5	97	5.81	6.16	5%	6%
70511161442	5/11/2016	9.49	8.37	ND/<3.3	ND/<3.3	13%	0%
70531161511	5/31/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
70601160955	6/1/2016	16.6	17	ND/<3.3	ND/<3.3	2%	0%
70601161550	6/1/2016	110	103	8.36	8.24	7%	1%
70607161358	6/7/2016	7.57	8.24	ND/<3.3	ND/<3.3	8%	0%
70608160910	6/8/2016	78.2	100	4.60 J	ND/<3.3	24%	**33%**
70630161448	6/30/2016	ND/<6.7	7.79	ND/<3.3	ND/<3.3	15%	0%

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70630161448	6/30/2016	ND/<6.7	ND/<6.7	ND/<3.3	ND/<3.3	0%	0%
70630161832	6/30/2016	8.39	7.99	ND/<3.3	ND/<3.3	5%	0%
70701160910	7/1/2016	38.8	40.1	ND/<3.3	ND/<3.3	3%	0%
70714161324	7/14/2016	11.3	12.1 J	ND/<2.8	ND/<2.8	7%	0%
70728161042	7/28/2016	41.8	36.9	2.87	ND/<2.8	12%	2%
70830161137	8/30/2016	6.77	6.71 J	ND/<1.0	ND/<1.0	1%	0%
40921161445	9/21/2016	4.57 J	4.45 J	ND/<1.0	ND/<1.0	3%	0%
40921161833	9/21/2016	5.34 J	6.18 J	ND/<1.0	ND/<1.0	15%	0%
70921161027	9/21/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
70921161330	9/21/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
70921161807	9/21/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
20922161934	9/22/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
40922161142	9/22/2016	9.79	9.66	ND/<1.0	ND/<1.0	1%	0%
20922161934	9/22/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
40926161655	9/26/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90926161108	9/26/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90926161535	9/26/2016	ND/<2.3	2.70 J	ND/<1.0	ND/<1.0	16%	0%
40927161225	9/27/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90927160919	9/27/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90927161555	9/27/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
40928161535	9/28/2016	3.50 J	4.22 J	ND/<1.0	ND/<1.0	19%	0%
70928161114	9/28/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90928161145	9/28/2016	13.40	14.20	ND/<1.0	ND/<1.0	6%	0%
90928161435	9/28/2016	**25.5**	24.20	2.61 J	2.22 J	5%	16%
40929161010	9/29/2016	3.07 J	2.41 J	ND/<1.0	ND/<1.0	24%	0%
70929160907	9/29/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90929161315	9/29/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
90929161631	9/29/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
40930160925	9/30/2016	ND/<2.3	ND/<2.3	ND/<1.0	ND/<1.0	0%	0%
71006161310	10/6/2016	11.4	11.2	1.00 J	1.03 J	2%	3%
71027161037	10/27/2016	73.9	83.0	2.96 J	3.51	12%	17%

Notes:

Bold and outlined = Relative Percent Difference (RPD) > 30%